position, what must be said about the question of superannuation? A short time ago a deputation consisting of representatives of the governing bodies of the Universities and institutions of University rank in England and Wales, together with representatives of the Association of University Teachers, waited upon the Chancellor of the Exchequer to put before him certain proposals regarding the present unsatisfactory state of superannuation in the Universities. Briefly these proposals were to the effect that the Government should grant University teachers the same, or similar, superannuation benefits as already granted to other branches of the profession under the School Teachers (Superannuation) Act, 1918, *plus* certain other benefits which the University teachers were prepared to pay for themselves by an annual premium on their salaries. The deputation was a most representative one and absolutely unanimous in its proposals. We now understand that the Chancellor is "prepared to consider the advisability of proposing to Parliament a further non-recurrent sum to assist the Universities in meeting the grievance of those senior members who are precluded from profiting to the full by the benefits of the University Superannuation Scheme." At the same time, it is announced that the Council of the Federated Superannuation System of the Universities has undertaken to obtain the information upon which the proposed non-recurrent grant will be made.

In all this there is not a word about giving University teachers the same, or similar, privileges that school teachers have in their non-contributory Government scheme. Not a word about facilitating the transference of teachers from the schools to the Universities or from the Universities to the schools, so that there would be no loss of superannuation benefits on the transference. Not a word about full retrospective benefits, irrespective of whether the service has been in schools or in Universities. Not a word about the consequent unity of the teaching profession. It would seem that the policy is to make such transference as difficult as possible. Now, obviously such a policy cannot be in the interests of education. It may be that we have placed too narrow an interpretation upon the words quoted above. We hope so. For, unless we are profoundly mistaken, the great bulk of the University teachers will be bitterly disappointed if the Government does not at least grant them benefits equivalent to those already granted to 95 per cent. of the teaching profession in the country.

Tanks and Scientific Warfare.

Tanks in the Great War, 1914–1918. By Brevet-Col. J. F. C. Fuller. Pp. xxiv+331+vii plates. (London: John Murray, 1920.) Price 21*s*. net.

THIS remarkable book is a clear and straightforward history of how the British Army learnt to use the most revolutionary weapon the great war produced. It is written by a confirmed believer in that weapon, whose belief probably became more and more complete as the Tank Corps gradually grasped a few of the principles involved in its use. It is somewhat of a pity that the author does not devote a chapter to the process by which the Tank Corps arrived at the tactics which eventually proved so successful. It took something like two years to overcome the prejudices raised against tanks in official quarters, and this in war-time, when progress is relatively rapid compared with that in peace. It is therefore to be hoped that the principles so ably set forth by Col. Fuller, and so well proved in the late war, will never again be overlooked.

It is only natural that it took many months for the Tank Corps to evolve anything like effective tank tactics. Many methods had to be tested in battle before being discarded, and it is not unusual, but rather a matter for congratulation, if the tactics evolved for the battle of Hamel were primarily suggested by the Australians, for it serves to show the close co-operation obtained, and the openmindedness of those in the Tank Corps to adopt the suggestions of others.

The history of tank tactics is an instance of how an effective weapon may be entirely wasted unless its use is understood. As to how much blame attaches to the Tank Corps for the use of tanks in the Ypres salient and similar misuses up to the first battle of Cambrai the author is silent, nor does it matter much, except that it serves to show how necessary it is for the expert on the new weapon to have some say in such matters. However, if, as Col. Fuller says on p. 58, the following lessons were learnt as the result of the first use of tanks on the Somme in 1916, especially No. 2, then the later tank actions need a lot of explanation.

The battle of Cambrai, although it demonstrated what tanks in numbers over good ground and without a preliminary bombardment could do, yet would have been a far greater success had the tank tactics as finally adopted at the battle of Hamel been in use. There is no question that the town of Cambrai itself would have been taken on the first day of the attack had proper co-operation with the infantry been maintained. The hold-up of tanks at Flesquières (p. 149) would not have taken place had the infantry been following the tanks closely, and could also have been got over by the tank crews getting out of their machines and stalking the field-gunner as infantry. The infantry on this occasion were several hundred yards behind!

This book makes one hope that someone will write the history of tanks from the civilian point of view. Read in conjunction with this excellent work, some of the more obvious mistakes in the past might thus be avoided in the future. It is now common knowledge that neither the War Office nor G.H.Q. welcomed "tanks," although it might be inferred from this book that they did so. The tank was fathered by the Navy, and had reached success before it was handed over. Its history was briefly as follows, and it is illuminating how little the Army contributed.

In Mr. Winston Churchill's letter to the Prime Minister of January, 1915, he remarks: "It is extraordinary that the Army in the field and the War Office should have allowed nearly three months of warfare to progress without addressing their minds to its special problems." It *was* extraordinary, and more so when they turned down any proposals made to them for breaking down the "trench warfare" into which both armies had settled. Mr. Winston Churchill made direct reference in this letter to armoured caterpillars and the way in which they should be employed.

There were many schemes put forward for carrying out this suggestion, but the successful one was produced by Major W. G. Wilson, who was then a lieutenant, R.N.V.R., in the Royal Naval Armoured Cars. Working in conjunction with Mr. (now Sir) William Tritton at the works of Messrs. Foster, of Lincoln, the machine was constructed and afterwards demonstrated at Hatfield. The designers called for a statement from the Army as to the width of trench to be crossed, height of parapet to be climbed, etc., and this was drawn up by Col. Swinton, who stands out at this time as practically the only champion tanks had in the Army.

Although the Navy fathered the production of the first tank, it was equally fortunate that after its success had been demonstrated at Hatfield to representatives from the War Office and G.H.Q., France, the future of tanks was entrusted to Sir Albert Stern. It was he who, when the first order for tanks was cancelled by the War Office, refused to cancel the order, and said he would, if necessary, pay for them himself.

Again, fate was kind to them on their first venture at the battle of the Somme. On September 15, 1916, two companies, each consisting of twenty-eight tanks, went into action. The company commanded by Major Summers got twenty-two machines into action, but only two of the other company crossed into No-man's Land. It is more than likely that, but for the efforts of Summers and his technical officer, Knothe, tanks would have been voted a failure and never given another trial. It is worth noting that both these officers were, prior to the war, civilians.

Again, it seems never to have been pointed out how the Army authorities failed to grasp the full importance of other proposals of the tank tribe. In 1916 the need of the moment was such protection against the machine-gun, but the early pioneers of the tank movement saw far greater possibilities in the caterpillar track. It was evident that roads and railways were the serious limiting factors to our armies. All supplies had to go by rail and road, and as these could be destroyed by the enemy's long-range artillery, the obvious need was for an alternative—something that could do without road or rails, and cross ploughed fields, shelled areas, hedges, and small rivers. The caterpillar track as used on tanks had been proved to be capable of doing this. Rightly or wrongly, the first attempt was made to design a caterpillar gun-carriage that would take a 5-in. gun or a 6-in. howitzer, or alternatively could be used to carry a large number of rounds of ammunition for either of these guns. It was designed so that the gun could be trained and fired from this movable platform, and the whole be capable of crossing shell-holes and trenches like the tank. The machine was tested at Shoeburyness, the gun being fired and trained with ease. Its value was never realised, and the scheme was allowed to drop. True, fifty machines of the first type were built, but nothing was ever made of the generic idea, and a second improved type, in which the faults of the first had been overcome, was allowed to lapse.

In the autumn of 1918 the value of a cross-country tractor was realised to the extent that many thousands were ordered here and in the U.S.A., but again "realisation" came too late, and none materialised.

As already stated, the Tank Corps insisted in interfering with design, with the result that progress and output were adversely affected. In numerous cases its wishes were followed, such as the change over from the Hotchkiss to the Lewis gun, the lengthening of the Mk. V. by 6 ft., the turning down of the G.C. Mk. II., and the Mk. IX. machine built to its requirements, and the results were, to say the least, serious.

However, Col. Fuller makes no comment on these points, but doubtless he would agree that in the future the Tank Corps in the field should confine itself to the problem of fighting the machine most effectively, and to giving the fullest possible information to the Headquarters Staff on which it may base its tactical requirements for the future classes of machines, these requirements to be conveyed to the designing department. How far such requirements can be met is for the designing and production departments to decide.

Much has been said about the use of tanks in small numbers at the battle of the Somme, and Col. Fuller is evidently of opinion that, had we held them back until large numbers were available, the element of surprise would have been so great as to have led to an overwhelming victory. The same might be said of the German use of gas for the first time against the Canadians. Personally, the present writer does not hold this view. A new weapon that is going to produce an overwhelming effect requires not only its use on a large scale, but also close co-operation with all other arms. This requires time and elaborate training, and training without the experience of actual battle is apt to be very misleading.

Mk. IV. tanks successfully took part in the decisive battles of the summer and autumn of 1918. It was this mark of machine that in 1917 the Tank Corps refused to accept, considering it useless. A little training in the proper way to fight with the new weapon had made all the difference. It was the Mk. IV. tank which carried out the brilliant operations with the Canadians in crossing the Canal du Nord in September, 1918 (see pp. 268–69). The officer in command of the Canadians after the battle sent for the officer in charge of these tanks and complimented him on the handling of the "new" type of tank and on the way in which all objectives were reached; the officer was silent, for they were the old Mk. IV. machines. The Mk. V. machine was a very great advance on the Mk. IV., but the greatest improvement of all was the realisation of how to use the new weapon in co-operation with the infantry.

Col. Fuller's book naturally deals chiefly with the fighting tank, and he clearly sets forth the claims of armour propelled by petrol as a protection and means of transport for the infantry against the machine-gun; but, as the author also points out, the German offensive of March, 1918, came to an end not so much on account of our resistance as because of the impossibility of bringing up artillery and supplies fast enough by the limited roads. The army of the future will be independent of roads and rails. Its artillery, supplies of shells, food, ambulances, etc., will be moved by petrol and caterpillar tracks.

The chapter on scientific warfare makes interesting reading. It might lead one to suppose that the wars of the future will be waged between small but highly trained armies, and that civilians will be carefully evacuated and safeguarded. The lesson of the late war seems to show that it will be impossible to protect civilians and increasingly difficult to discriminate between the trained warrior and women and children. The use of gas over large areas, of explosive dropped by aircraft, of huge tanks and tractors dashing over hill and dale, in their course passing over hamlets and villages, seems to make the lot of the non-combatant an unenviable one. Possibly this is all for the best, and certainly so if it acts as a deterrent to future wars.

In conclusion, one must say that the book is most excellent reading and remarkably free from controversy or axe-grinding. It has been said that the indication of the object of a war book can be got from the frontispiece. Many have a portrait of the writer, but this starts with a picture of the weapon which had such an effect on history, and the book is a valuable tribute to it (see p. 48).

Physiology of Farm Animals.

Physiology of Farm Animals. By T. B. Wood and Dr. F. H. A. Marshall. Part i. *General.* By Dr. F. H. A. Marshall. Pp. xii+204. (Cambridge: At the University Press, 1920.) Price 16*s.* net.

SUCCESS in the rearing and feeding of animals depends to a large extent upon the practical application of the principles of physiology. Yet, although the breeding of farm animals and the production of meat and milk are of such great economic importance, the study of the physiology of farm animals has received comparatively little attention. The appearance of this text-book is, therefore, welcome. The reputation of the writers is likely to secure a wide use of the book in agricultural teaching centres.

The first volume deals with the general principles of physiology. It is lucidly written, and the illustrations are well chosen. The parts of the subject most fully treated are those which are of special practical importance, viz. the digestive system, the organs of locomotion, and the organs of reproduction. A clear account is given of the digestive system. The chapter on the organs of locomotion contains a very useful